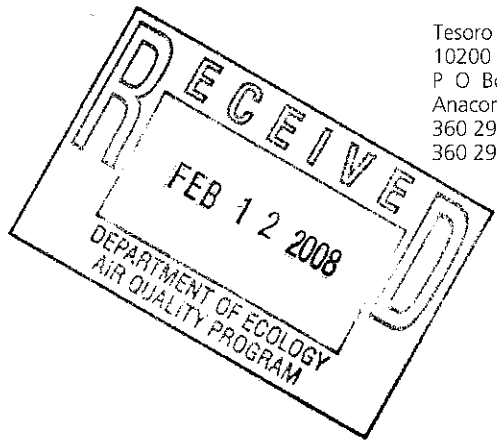
TESORO

Tesoro Refining and Marketing Company
10200 West March Point Road
P O Box 700
Anacortes, WA 98221
360 293 9119
360 293 9190 Fax

February 8, 2008



Ms. Phyllis Baas, Section Manager
Technical Services Section
Air Quality Program
Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

SUBJECT: RESPONSE TO BART ANALYSIS ORDER NO. 5076
TESORO ANACORTES REFINERY

Dear Ms. Baas:

As required by the Regulatory Orders of August 24, 2007 and October 4, 2007, this letter is submitted to provide the Washington State Department of Ecology (Ecology) with results from our assessment of options for control of visibility impairing pollutants from BART-eligible units at the Tesoro Anacortes Refinery.

A) BART-Eligible Units

The following is a listing of emission units constructed at the Anacortes Refinery during the time interval of August 1962 through August 1977:

Process Heaters: F-103, F-104, F-654, F-6600, F-6601, F-6602, F-6650, F-6651, F-6652, F-6653, F-6654 and F-6655
Boilers: F-304 (Cat Cracker CO Boiler #2)
Flares: X-819
Cooling Water Towers: #2 and #2a
Storage Tanks: 109, 113, 114, 115, 134, 135, 136, 142, 148, 160 and 161

B) Pre-Control Visibility Impairment – Exemption Modeling

In accordance with the United States Environmental Protection Agency (U.S. EPA) and Ecology modeling protocol, Tesoro identified the maximum 24-hour average emissions of BART pollutants during years 2003 through 2005 from each of the BART-eligible heaters and boilers. For the process heaters, the calculations were based upon daily fuel type, fuel use rates and fuel quality records. Emission rates of sulfur oxides were based upon material balance calculations while emissions of

nitrogen oxides and particulates were based primarily upon factors provided in U.S. EPA guidance document AP-42. In the case of CO Boiler F-304, Tesoro utilized source test data. Due to lack of daily data for the flare and cooling water towers, maximum 24-hour emission rates were based upon estimated annual emissions - computed from engineering assessment and AP-42 factors. Storage tank VOC emissions were not included in the modeling exercise. As discussed below, total VOCs from all BART-eligible units is less than the 250 tons/yr threshold.

Attachment 1 provides a summary of maximum 24-hour emission rates. These data were used by our air modeling contractor, Geomatrix, to assess visibility impairment and to assess whether the Anacortes refinery might be exempted from having to perform pollution control technology assessments. Enclosure #1 is a copy of the Geomatrix modeling report. As seen at Table 4-4 of the document, the computed impact from this facility is greater than the threshold of 0.5 deciviews (dv), with the greatest visibility impact (1.72 dv) during the BART years occurring at Olympic National Park. The Geomatrix study indicates that 57.5% of this impairment is due to nitrates, with 41.5% due to sulfates and the balance (1.0%) due to particulates.

C) Assessment of Feasible Controls

For the determination of feasible technologies for control of nitrogen oxides from Anacortes Refinery BART-eligible combustion units, Tesoro retained the services of Anvil Corporation. The assessment of options for sulfur oxides and particulates was developed internally by Tesoro. In the feasibility assessments discussed below, we have utilized a capital cost recovery factor based on an interest rate of 7% and a retrofit equipment life of 10 years for burners and a 15-year retrofit equipment life for all other technologies. In making our technology commitments, we have utilized feasibility thresholds of $8,000/ton - absolute, and $12,000/ton - incremental.

Nitrogen Oxides

Submitted with this letter (Enclosure #2) is a copy of the assessment report of NOx control technologies. From this study, the six units shown in the table below were determined to have technically feasible NO_x controls that are considered to be BART.

Unit	Technically Feasible Option*	NOx Reduction (Tons/yr & %)	Capital Cost ($ Million)	Cost Effectiveness ($/Ton)
F-103	LNB	80 & 66%	1.98	$4,648
F-304	LNB+SNCR	323 & 39%	7.01	$4,592
F-6650 & 51 F-6652 & 53	LNB ULNB	202 & 72%	3.62	$3,349

*Notes: LNB = Low NOx Burners; SNCR = Selective Non-Catalytic Reduction;
ULNB = Ultra Low NOx Burners

Sulfur Oxides

The majority of the BART-eligible combustion units at the refinery burn only refinery fuel gas or natural gas. While there are SO_2 add-on control technologies available

(i.e. wet gas scrubbers), for this type of emission unit, a review of the U.S. EPA's RACT/BACT/LAER Clearinghouse (RBLC) database indicates that BACT for SO_2 emissions is "burn low sulfur fuels."[1] Therefore, the BART analysis of SO_2 emissions presented below focuses on a review of the ability for Tesoro to reduce the sulfur content of the fuels burned in the combustion units.

During 2007, additional H_2S treatment and handling capacity was placed into service at the Anacortes Refinery. As the result of these projects, our current refinery fuel gas H_2S limit is now 0.1%v (1000 ppm) on a 365-day rolling average. During years 2003 through 2005, the refinery-wide fuel gas limit was the NWCAA hourly flue gas standard of 1000 ppm SO2 (equivalent to ~ 10,000 ppm H_2S). A separate limit applicable to process heater F-104 (4300 ppm H_2S) effectively established a longer term (calendar month) limit for the fuel gas system. On typical days the refinery now operates at a fuel gas H_2S concentration of 70 ppm or less, but does experience spikes from time to time at concentrations in excess of 200 ppm H_2S. Prior to the treatment system upgrade, the average H_2S content of refinery fuel gas during years 2003 through 2005 was 980 ppm.

Historically, this location has also burned liquid fuel oil at BART unit F-103. Over the past few years, approximately 10% of the SO_2 from BART-eligible units has been from the burning of fuel oil at F-103.

Under the refinery's current configuration, there is no more capacity to handle the additional sulfur and reliably further reduce the H_2S content of the refinery fuel gas. With this as background, the following is a list of options and associated costs for reduction of sulfur dioxide from refinery combustion units:

1) Installation of a new sulfur recovery unit for assured and sustained additional control of H_2S in the fuel gas burned in refinery process heaters. The capital cost of a 50 ton/day SRU, including associated changes within the refinery, is $58 million.[2] The cost effectiveness of this option is $16,100/ton SO_2 when controlling continuously and reliably to a limit of 162 ppm H_2S (achieving a reduction of 395 tons/yr relative to BART base-line years 2003-2005), or $14,100/ton SO_2 when controlling continuously and reliably to a limit of 50 ppm H_2S (achieving a reduction of 451 tons/yr relative to the BART base-line years). Attachment 2 displays the computation of the cost effectiveness values. Please note that Tesoro considers these cost effectiveness evaluations to be understated given that associated annual operational costs have not been included.

   When taking into account recently improved performance of the refinery fuel gas treatment system (i.e., typical operation at 70 ppm H_2S or less), the cost effectiveness for controlling continuously and reliably to a limit of 50 ppm via the

[1] Please note that this statement does not apply to F-304 since this CO boiler is a component of the Tesoro Catalytic Cracking Unit. Add-on technologies for SO_2 control are more common on Catalytic Cracking Units. Tesoro has already installed a wet gas scrubber on the Catalytic Cracking Unit for SO_2 and PM control which is discussed in this report

[2] The basis for the SRU estimate is from a planned project for a new Coking Unit considered for installation in 2006. This project has been cancelled.

SRU option, (providing an increment of additional reduction of only 10 tons/yr SO_2), increases to $637,000/ton SO_2. (see Attachment 2)

2) Discontinuation of fuel oil burning at F-103. Over the past few years, the price differential between refinery fuel oil and natural gas (the marginal fuel at the Tesoro refinery), has declined. At the present time, there is little expense associated with this option. However, please note that the price differential could become significant in the future and result in a cost to us given that we are proposing to eliminate the full flexibility of being able to burn fuel oil in F-103.

3) Additional Flare Gas Recovery. Gases burned at Flare X-819 consist of purge gas (natural gas), pilot gas (natural gas) and miscellaneous gases of variable quality associated with loading operations and process vents. Occasionally, gases from process upsets, startups and shutdowns are also combusted at the unit. The refinery operates a flare gas recovery compressor which serves to route most gases to treatment and then to the refinery fuel gas system. Because of the high variability of flow and quality of the flare gases actually burned at the flare, there is no technology available to further reduce flare SO_2 emissions. We estimate SO_2 emissions from the flare to be on the order of 10 tons per year. If a second flare gas recovery compressor (capital cost of $2 million, routing additional gas to the fuel gas treatment system) were to be installed and if it enabled the refinery to eliminate the 10 tons/yr of emissions, the cost effectiveness would be $22,000/ton (see Attachment 2).

Note: The U.S. EPA and Ecology BART guidance allows for the ability to avoid a full-scale BART analysis if a unit already has emission controls installed and emissions limits for a BART pollutant that is required by a permitting process under the Clean Air Act. As required by Order of Approval to Construct #946a, a flue gas scrubber (FGS) was installed on the refinery's Cat Cracker in 2005. The FGS serves to reduce emissions of SO_2 from the unit's two CO boilers to permit limits of 25 ppmdv on a rolling 365-day basis and 50 ppmdv on a 7-day average basis. These emission limits are equivalent to those of recent BACT determinations and U.S. EPA consent decrees. Therefore, further consideration of SO_2 control at CO-Boiler F-304 is not required.

Particulate Matter

As noted above, the majority of the BART-eligible combustion units at the refinery burn only refinery fuel gas or natural gas. Therefore, particulate emissions (PM) from these units are inherently low. While there are PM control technologies available (baghouses, wet or dry electrostatic precipitators, wet scrubbers), Tesoro considers that any add-on technology for gas fired combustion units would be easily considered cost ineffective as BART given the inherently low baseline emissions. This conclusion is consistent with a review of U.S. EPA's RBLC database which demonstrates that BACT is determined to be "good combustion practices" for gas-fired combustion devices and no add-on controls are required.

As seen in Attachment 1, the burning of fuel oil at F-103 is the second largest source of particulates from the Anacortes BART-eligible units. Discontinuation of oil

burning at the unit will reduce particulate emissions by 26%. As discussed above under the discussion of control options for sulfur oxides, there is at the present time, no expense associated with the option of not burning fuel oil. However, this could become a cost to Tesoro in the future if the cost differential between refinery fuel oil and natural gas changes in the future.

Particulate emissions from the two BART cooling water towers amount to 0.2 lb/hr (0.6% of the total from the BART-eligible units) Emissions from tower #2 could be reduced by about 90% through installation of newest design drift control panels. At a cost of $150,000, the cost effectiveness for control is approximately $41,800/ton. Cooling tower #2a is already equipped with control panels regarded as state-of-art. Attachment 2 provides the cost effectiveness determination and Attachment 3 provides background information.

Note: The use of ammonia based technology to control nitrogen oxide emissions will increase particulate emissions. It is premised here that residual ammonia and ammonium particulates associated with an SNCR installation at CO Boiler F-304 will be captured by the Flue Gas Scrubber.

Note: The U.S. EPA and Ecology BART guidance allows for the ability to avoid a full-scale BART analysis if an emission unit already has Maximum Achievable Control Technology (MACT) required emission controls installed and emissions limits for a BART pollutant. The FGS that was installed on the Anacortes Cat Cracker in 2005 serves to reduce emissions of particulates from the unit's two CO boilers and meets the Petroleum Refinery MACT II PM limit of 1 lb PM/1,000lb coke burn. Therefore, further consideration of PM control at CO-Boiler F-304 is not required.

VOCs

Annual VOC emissions from the eleven storage vessels constructed during years 1962 through 1977 is 67 tons. VOC emissions from the other BART-eligible units are estimated at 45 tons per year. Per U.S. EPA and Ecology guidance, VOC contributions to regional haze do not need to be considered when the annual rate of VOC emissions from BART-eligible units is less than 250 tons/year.

D) BART Substitution Options

Tesoro is appreciative of the time extension granted by the Department (letter of 10/04/07) allowing us to explore the possibility of installing controls at non-BART units in the place of BART-eligible units. Tesoro has examined NOx control options at five other large combustion units at the refinery. We wish to advise that we were not able to find any options that were financially more attractive.

E) Feasible BART Controls

We understand that the following measures will be required within 5 years of the Washington State Regional Haze State Implementation Plan (SIP) being approved by U.S. EPA:

- Installation of low NOx burners at process heater F-103,
- Installation of low NOx burners plus SNCR at CCU CO Boiler F-304,
- Installation of low NOx burners at process heaters F-6650 and F-6651 along with Ultra low NOx burners at heaters F-6652 and F-6653, and
- Discontinuation of routine burning of fuel oil at F-103. We wish to emphasize that the capability to burn fuel oil in this unit is a necessity for periods of natural gas curtailment, startups and shutdowns of major process units, and in the event of unforeseen emergencies which limit fuel gas availability. The burning of oil at heater F-103 for a few hours each year will need to be carried out for assured operator proficiency in making fuel changes.

F) Visibility Improvement

Based upon the anticipated emission reductions, as shown in Attachment 1, the computed maximum visibility impairment impact from Tesoro BART-eligible units decreases from 1.72 dv to 1.25 dv (see Tables 4-4 and 4-5 of Enclosure 1).

As has been already discussed with Ecology, while we are proposing specific technologies and practices to meet the BART requirements, Tesoro requests that the BART regulatory order not require the specific technologies to be installed, but instead be based upon the degree of emission reductions offered. As you are aware, the requirement to install these technologies is within 5-years after the Washington State Regional Haze SIP is approved by the U.S. EPA. During this time period, the availability, costs, and technical feasibility of these technologies could change. In addition, new technologies or improvements to existing technologies could become available. The latter could also result in a viable Better-than-BART option. Therefore, Tesoro also requests that any order issued by the Department include the flexibility to nominate controls at non-BART units, provided of course that an equal or greater degree of visibility improvement can be demonstrated through the trading of the emissions units. Focusing the BART regulatory order on the amounts of emission reductions offered in this letter, versus stipulation of specific technologies, will allow Tesoro and Ecology the opportunity to achieve program objectives in the most cost effective manner.

If you have any questions regarding this response, please contact John Giboney at 360-293-1618

Sincerely,

Don J. Sorensen
Refinery Manager

Attachments
Enclosures

cc with copies of attachments:

Ms. Toby Allen, Air Quality Engineer
Northwest Clean Air Agency
1600 South Second Street
Mount Vernon, WA 98273-5202

Attachment 1

Base Case and BART Case Air Modeling Emission Rates
Tesoro Anacortes Refinery

Unit	Maximum Emission Rate			Stack Parameters			
	SO2 (Lb/hr)	NOx (Lb/hr)	PM (Lb/hr)	Height (ft)	Diameter (ft)	Temp (F)	Flow (acf/s)
A) Base Case							
F-103 (gas & oil)	160 5	53.5	9.1	151 0	6.5	606	1381
F-104	39 8	0.8	0 4	150.0	3.0	530	285
F-304 / FGS	24 9	242 7	14.1	199.0	11 5	155	4140
F-654	11 7	1.3	0.1	130 0	3.0	682	185
F-6600	56 0	13.1	0.9	150 0	5 0	785	869
F-6601	77 5	8.0	0 6	150.0	3 1	538	528
F-6602	25.6	8.3	0.6	157.0	2 6	772	760
F-6650/51	332 0	101 3	2.8	150.0	7 0	520	2112
F-6652/53	86 1	19 2	1 5	150 0	7.0	526	1349
F-6654	32 2	4 0	0.3	150 0	2 6	533	273
F-6655	15 1	2.9	0 2	90 0	4 5	1002	587
Flare X-819	10	2.0	0.4	40.0	15.0	1200	423
CWT #2	0	0	0.1	49 6	36 0	100	28800
CWT #2a	0	0	0.1	41.8	31.1	100	17300
Total	871 4	457.1	31 2				
B) BART Case							
F-103 (gas only)	152 5	18.1	1 4	151.0	6 5	594	1485
F-104	39.8	0.8	0 4	150.0	3.0	530	285
F-304 / FGS	24.9	148.0	14.1	199.0	11 5	155	4140
F-654	11.7	1 3	0.1	130 0	3.0	682	185
F-6600	56 0	13.1	0 9	150 0	5 0	785	869
F-6601	77 5	8 0	0.6	150.0	3 1	538	528
F-6602	25.6	8.3	0.6	157.0	2.6	772	760
F-6650/51	332 0	28 3	2.8	150.0	7.0	520	2112
F-6652/53	86.1	5 2	1 5	150 0	7.0	526	1349
F-6654	32 2	4 0	0 3	150 0	2 6	533	273
F-6655	15 1	2.9	0 2	90 0	4 5	1002	587
Flare X-819	10	2.0	0.4	40.0	15 0	1200	423
CWT #2	0	0	0.1	49.6	36 0	100	28800
CWT #2a	0	0	0.1	41 8	31.1	100	17300
Total	863.4	240.0	23.5				

Summary of emission revisions in the BART Case

F-103 (gas only)	Delta NOx = 66 2% reduction (Low NOx Burners)
	Delta SO2 = 5% (discontinuation of fuel oil burning)
	Delta PM = 85% (discontinuation of fuel oil burning)
F-304 / FGS	Delta NOx = 39 0% reduction (Low NOx Burners + SNCR)
F-6650/51	Delta NOx = 72 1% reduction (Low NOx Burners)
F-6652/53	Delta NOx = 73.1% reduction (Ultra Low NOx Burners)

Attachment 2

Miscellaneous BART Cost Effectiveness Determinations*

Unit	Pollutant	Emission Rate value	Emission Rate Units	Reduction (%)	Reduction (Tons/yr)	Capital Cost ($MM)	Capital Cost Recovery Factor	Cost Effectiveness ($/ton)
Sulfur Recovery Unit **	SO2				395	58	0.1098	16,123
Sulfur Recovery Unit ***	SO2				451	58	0.1098	14,121
Sulfur Recovery Unit ****	SO2				10	58	0.1098	636,840
Flare Gas Recovery Comp.	SO2				10	2	0.1098	21,960
Cooling Water Tower #2	PM	0.1	lb/hr	90	0.39	0.15	0.1098	41,781

Notes:

* Effectiveness values shown here are based upon capital costs only; operating expenses not yet considered

** For assured compliance with a fuel gas standard of 162 ppm H2S

*** For assured compliance with a fuel gas standard of 50 ppm H2S

**** For assured compliance with a fuel gas standard of 50 ppm H2S based on current operations following fuel gas treatment system upgrades installed in 2007

Attachment 3

Giboney, John

From: BRUCE.SCHAEFER@ct.spx.com
Sent: Friday, February 08, 2008 9:34 AM
To: Giboney, John
Subject: Drift reduction, Cooling Tower #2, Tesoro Anacortes WA

This note is sent to confirm our discussion at the refinery that the cost associated with installation of state-of-the-art drift control panels at Cooling Tower #2 would be on the order of $150,000 and should provide a reduction in drift related emissions of 80 to 90%.

Sincerely,
Bruce Schaefer
SPX Cooling Technologies"

SPX Cooling Technologies Inc., Santa Rosa Office,
(OEM for Marley, Ecodyne, Hamon, Ceramic, Balke)
1658 Kerry Ln.
Santa Rosa, CA 95403
Phone 707 525-0721, Fax 913 693-9680
Cell 707 280-0179
bruce.schaefer@ct.spx.com

!!!PLEASE NOTE NEW EMAIL ADDRESS ABOVE!!!